AA Physical Properties

Amino acids are the building blocks of peptides and proteins, and while they all have common elements of an amine group, a carboxyl group and a side chain, the various functional groups that comprise the side chain give each amino acid distinct physical properties that influence protein formation and function. Understanding these physical properties, including charge, solubility and pKa, aid in designing peptide sequences that are optimized for high synthesis yield and purity. To simplify the handling of peptide sequences, each amino acid has a designated single-letter code. The table below includes the single-letter codes and physical properties of the 20 standard amino acids.

Table of amino acid physical properties

Amino Acid	Code	Hydropathy	Charge	pKa, NH2	pKa, COOH	pK(R)	Solubility
Arginine	R	hydrophilic	+	9.09	2.18	13.2	71.8
Asparagine	N	hydrophilic	N	8.8	2.02		2.4
Aspartate	D	hydrophilic	-	9.6	1.88	3.65	0.42
Glutamate	E	hydrophilic	-	9.67	2.19	4.25	0.72
Glutamine	Q	hydrophilic	N	9.13	2.17		2.6
Lysine	K	hydrophilic	+	10.28	8.9	2.2	
Serine	S	hydrophilic	N	9.15	2.21		36.2
Threonine	T	hydrophilic	N	9.12	2.15		freely
Cysteine	C	moderate	N	10.78	1.71	8.33	freely
Histidine	H	moderate	+	8.97	1.78	6	4.19
Methionine	M	moderate	N	9.21	2.28		5.14
Alanine	A	hydrophobic	N	9.87	2.35		15.8
Valine	V	hydrophobic	N	9.72	2.29		5.6
Glycine	G	hydrophobic	N	9.6	2.34		22.5
Isoleucine	I	hydrophobic	N	9.76	2.32		3.36
Leucine	L	hydrophobic	N	9.6	2.36		2.37
Phenylalanine	F	hydrophobic	N	9.24	2.58		2.7
Proline	P	hydrophobic	N	10.6	1.99		1.54
Tryptophan	W	hydrophobic	N	9.39	2.38		1.06
Tyrosine	Y	hydrophobic	N	9.11	2.2	10.1	0.038